rax united, stout, moderately curved, obsoletely carinated above, thickly and closely punctured, the punctures confluent, sparingly pilose, slightly incrassated towards the apex. Antennæ rather long, rufo-piceous, pilose. Thorax transverse, abruptly narrowed in front, greatly dilated and rounded at the sides a little before the middle, slightly convex above, obsoletely carinated and thickly and closely granulated. Scutellum elevated, tuberculiform. Elytra oblong-ovate, the shoulders elevated, rounded, the sides not distended, moderately convex above, punctate-striate, the interstices broad, plane, closely granulated; rather thickly clothed with hairs, variegated with cinereous and fuscous. Legs moderate piceous-black; femora subclavate, simple; tibiæ straight, densely pilose, rufo-piceous, dentate at the apex internally; tarsi rufo-piceous. Length 3 lines.

Formerly I referred this to the preceding insect, but upon a closer examination I think it is sufficiently distinct, and may be discriminated, independent of minor differences, by having the head foveolated, the rostrum slightly incrassated at the apex, and the thorax granulated. *P. Steveni* of Schönherr agrees with this insect in many of its essential characters, and possibly may turn out a variety; but the thorax is described by Gyllenhal as very closely punctured, and the interstices between the striæ on the elytra as coriaceous.

The only specimen I have seen was found amongst moss and decayed vegetable matter from a wood at some distance from Carlisle in December by T. C. Heysham, Esq., who kindly presented it to me.

XVIII.—*On the Structure of the Shell of the Egg in Birds, and the nature and seat of the Colour.* By G. Dickie, M.D., Lecturer on Botany in the University and King's College of Aberdeen.

[With a Plate.]

Some remarks under the above title formed the subject of a communication read at a meeting of the Aberdeen Philosophical Society, March 6th, 1841. Not having since that time, in the course of my reading, met with any recorded facts of a similar nature, they are now offered, with some additions, as a contribution to that branch of ornithology termed Oology. Through the liberality of my friend Professor MacGillivray of Marischal College, I have recently had an opportunity of examining eggs not previously in my possession.

In Carpenter's 'Manual of Physiology' the following statements are made respecting the development of the outer cover-

ings of the ovum. "As the ovum passes along the oviduct of the parent it receives its coating of albuminous matter, of which layer after layer is thrown out by the vessels of the oviduct. When a sufficient supply has thus been furnished, it appears that fibrinous instead of albuminous matter is poured forth, and this in coagulating forms a very thin layer of fibrous tissue which envelopes the albumen. Layer after layer is gradually added, and at last, by the superposition of these layers, that firm tenacious membrane is formed, which is afterwards found lining the egg-shell. The process is then continued with this variation, that carbonate of lime is also secreted from the blood in a chalky state, and its particles lie in the interstices of the fibrous network, and give it that solidity which is characteristic of the shell. If they be removed by the agency of a weak acid, or if the bird be not sufficiently supplied with lime at the time of laying, the outer membrane has the same consistence as the inner; and either may be separated after prolonged maceration, by dextrous manipulation, into a series of layers of a fibrous matting." I am indebted to Professor Fleming for an extract from Purkinje's essay on the Development of the Egg previous to Incubation. He describes the membrane of the shell as composed of two layers, the internal consisting of minute interwoven fibres; the outer, he says, presents no peculiar structure. The calcareous matter first appears in the form of polygonal crystals, which afterwards coalesce.

Sometimes the surface of the shell is smooth and glossy, occasionally unpolished but smooth, in other cases rough and granular, and in not a few covered with a superficial layer which may be easily removed. Such differences (as well as those having reference to colour) will of course affect the transmission of caloric to or from the contents of the egg, and these differences are accounted for by facts now to be stated.

My aim had been originally to ascertain merely the nature and seat of the colouring matter of the shell; it is freely acknowledged that the observations were begun with a preconceived idea that the calcareous part might be the seat of the colour. It was expected therefore that on placing a coloured egg in diluted muriatic acid, a coloured solution might be procured which could then be examined by chemical tests. The egg of the common guillemot (*Uria Troile*, Temm.) was first tried; its colour is usually bluish green with dusky blotches, sometimes the ground colour is white. The application of an acid soon proved the colour to be partly superficial; shreds of a fine membrane were detached; these on examination with the microscope were found to possess a distinctly cellular structure; a pale membrane of like appearance could be separated from the surface of the white

variety. A similar structure was readily detected in other eggs, as those of the common fowl, bantam fowl, thrush, hedge-sparrow, &c. Careful examination of this superficial membrane led to the discovery of a finer, almost structureless, but membranous film beneath it. There had thus been detected a layer not alluded to by Purkinje, and in addition it was found that, contrary to the statement of that observer, the outermost covering of the shell really has a peculiar structure. In a word, the shell of the egg has the same general arrangement of parts as a mucous membrane or the skin: a superficial layer composed of cells, and another generally of finer texture on which it rests; the former corresponding to the epithelium, the latter to the basement membrane, as they are denominated by histologists.

In some cases the superficial layers are so delicate that the action even of very weak acid tears them into shreds, and when they are colourless or nearly so they may escape observation altogether.

It may not be irrelevant to state generally the facts ascertained regarding tissues similar to those under consideration. The epidermis or cuticle which covers the external surface of the body is composed of layers of cells, the most superficial continually wearing away or falling off; the deeper layers consist usually of nucleated cells; the more external do not necessarily include nuclei. The corresponding layer on the free internal surfaces of the body, and which is usually called epithelium, has a similar structure, consisting of flattened, often polygonal cells, sometimes in contact with each other, and forming consequently a continuous layer, but in some cases separated by considerable interstices; this variety is usually called tessellated or pavement epithelium, to distinguish it from that kind furnished with cilia. Beneath the epithelium we have the fine tissue denominated basement membrane. In its simplest form it is of extreme delicacy; "in some cases, to all appearance, perfectly homogeneous, presenting no trace of regular structure, appearing like a thin film of coagulated gelatine." Sometimes it is distinctly granular or even composed of nucleated cells.

The texture and consequently general appearance and thickness of the epithelium differ very much in different eggs. In that of the ostrich (Pl. VII. fig. 1) it is composed of contiguous thick-sided polygonal cells very much resembling the horny epidermis found upon the conjunctiva covering the cornea. In that of the emeu there exists a structure nearly similar, only the cells are smaller, and sometimes they are not contiguous but scattered. The surface of the egg of the emeu is very irregular, being covered with ridges and intervening furrows; it is quite possible that the structure of the epithelium on the ridges may differ

from that in the grooves, but the small morsel of shell at my disposal prevented me from fully ascertaining this. I have not met with any other instance in which the epithelium presents a structure so decidedly cellular as in the former of the two above mentioned; still there are some in which there can be no doubt as to the nature of the tissue, the cells being, however, less distinct and rather irregular in size and form; as examples may be mentioned the guillemot, missel thrush, land rail, common grouse, redstart, greenfinch, &c. I have met with several instances in which the cellular structure of the superficial layer is not so evident, as in the blackbird, hedge-sparrow, chaffinch, common lark, &c. I am indebted to Mr. Strickland for an opportunity of perusing remarks on Oology by M. Des Murs, published some years ago. He speaks of the connexion between the appearance of the surface of the egg and the habits of birds and the climates in which they permanently reside, or in which they pass the breeding-season. He alludes to those of aquatic birds generally as having a shell, whose surface is usually unpolished; in some, as the cormorants and others, the superficial layer is easily detached. I may mention as an instance of this, the egg of the *Carbo Floridanus*; the surface is rough and without gloss, and appears as if it had been white-washed. This is owing to the nature of the epithelium, which is strong and composed of numerous crowded granules and cells. The use of an acid is not necessary for the separation of this epithelium, for if the surface of the egg be moistened, the superficial layer may be peeled off in pieces of considerable size. The fragments thus separated effervesce strongly with acid, and require its application previous to the use of the microscope, proving that in this instance at least, a quantity of calcareous matter is deposited in the epithelium and not in the fibrous layer only. A perpendicular section of the shell in this particular case shows that the thick epithelium with its calcareous deposit forms about one-fourth of the entire thickness. The egg of the *Ardea Herodias* (Linn.), like that just mentioned, has a superficial layer which may be easily removed; it will be found to contain calcareous matter, and in some cases I have seen this deposit arranged in radiating crystals, presenting an appearance like that observed by Dr. Carpenter in the tooth of *Mya arenaria*, and compared by him to radiating arragonite or wavellite.

Des Murs alludes to a remarkable example, and, as he says, unique in the entire family of birds denominated terrestrial or non-aquatic: the case mentioned is that of the egg of the *Crotophaga Ani*; the surface is rough and covered with a chalky layer, on detaching which the egg is of a deep blue.

The nucleus of the epithelium cells is usually absent; it is

however evidently present in those of *Ardea Herodias, Fuligula mollissima, Sterna arctica*, &c. In some instances the most superficial layer which I have been able to detect possesses no distinct cellular structure properly so called, but might be described as mostly granular, as in the wheat-ear, kestrel, mocking-bird, &c., or granulo-cellular, as in the egg of the darter from S. Carolina. In the epithelium of the egg of the wheat-ear, the granules when highly magnified seem to be often in linear and branched series, presenting therefore a faintly fibrous appearance.

Basement Membrane.—This layer, which is very evident in some instances, is not so easily observed in others. It is usually of very delicate structure, rendering careful manipulation necessary to demonstrate its presence. It is well-developed in the egg of the ostrich, in which its structure is densely granular. In the egg of the lapwing, &c., the granules under a high power appear to have a linear and sometimes branched arrangement, thus apparently presenting a transition to the fibrous structure.

In eggs of considerable size with a strong shell there appear to be several layers, at least of epithelium if not also of basement membrane, and in several instances the structural difference between the two is not very evident, there being a passage of one into the other.

In some cases, as in the egg of the blackbird, &c., there may be observed, first a delicate epithelium, beneath it a basement membrane, and lastly a single layer of loose fibrous tissue.

The colours of eggs may be viewed under two heads, first the ground colour, second the spots or blotches; these last are of various forms and sizes, and may either have a well-defined distinct outline, or their outline may be ill-defined.

M. Des Murs, in his remarks on this subject, inquires whether these colours are due to the chemical combination of sanguineous matter with the calcareous shell, or whether they are specially secreted by peculiar glands. He states that the minute papillæ which line the oviduct, and which pour into it the calcareous matter to form the shell, do also give vent at the time of egg-laying to sanguineous exudations which may cause the colour. But on the other hand he relates that he once found a lapwing's egg of a uniform green, almost wholly spotless. On blowing out the yolk and albumen, he further expelled a black and glairy lump, consisting of an agglomeration of the colouring matter, of a greenish brown, floating in albumen, and inclosed in a transparent follicle. This he says would seem to show that the colouring matter is a special secretion prepared beforehand in the oviduct, and in the present case he supposes that the mass of colouring matter had by some accident become inclosed within the shell instead of being distributed over its outer surface.

Nevertheless having failed to discover any special receptacle for such a secretion he adopts the first hypothesis, and supposes that the egg in descending the oviduct presses against the papillæ and causes sanguineous exudations, the ferruginous matter of which produces the brown spots on the shell. The *forms* of these spots he believes to afford proof of the opinion. The ground colour of eggs (whether uniform or spotted) he considers not to be a property of the calcareous matter as originally secreted, but to be subsequently superinduced, as is the case with the spots, the difference being that in the case of the ground tints the chemical combination of blood with calcareous salts which produces the colour takes place *uniformly*, and not *partially* as in the spots.

It may not be irrelevant to state briefly the facts recorded by histologists regarding coloured deposits in animal tissues. In the coloured races of men and in some portions of the skin of the white race, the colouring matter is usually deposited in some of the deeper-seated epidermic cells. In the substance of the choroid coat of the eye, in the iris, and in some parts of the sclerotic coat, there exist pigment-cells of irregular form. The epithelium cells of the inner surface of the choroid are also filled with colouring matter. This matter, differing somewhat in colour and intensity, consists of oval or oblong grains usually of very small size, $\frac{1}{10000}$th of an inch or less, and crowded in the interior of the cells.

The ground colour of the egg-shell may reside partly in the epithelium and partly in the deeper layers; in the former case the action of an acid by removing the epithelium scarcely affects the colour, rendering it only rather paler. As an instance may be mentioned the egg of the hedge-sparrow (*Accentor modularis*, Temm.); its most superficial layer or epithelium is readily detached on the application of weak acid; it is of great tenuity and mostly of a granular structure; the granules in the mass are of a very faint bluish green; the separation of this layer scarcely affects the general blue colour of the egg. When all the calcareous matter has been removed the remaining membranes are still blue, the colour residing in the deeper layers; the same general arrangement will be found in the eggs of the redstart (*Sylvia Phœnicurus*, Temm.), the wheat-ear (*Saxicola Œnanthe*, Bechst.), and *Turdus mustelinus*, Gmelin, in all of which the colour is nearly similar, differing only in its intensity.

As already mentioned, the spots may have a well- or ill-defined outline; both kinds are often to be observed upon the same egg, as in *Larus glaucus*, Temm., *Larus Rissa*, Mont., *Sterna arctica*, Temm., and others.

The egg of the common thrush (*Turdus musicus*, Linn.) is

usually blue with generally well-defined black spots; the epithelium is very thin; the black spots mostly reside in it, and are produced by the congregation of minute pigment-granules which are of a dark brown; the ground colour is seated in the layer beneath.

In the egg of the kittiwake the epithelium is thin and almost colourless; the well-defined spots are seated in it. The deeper layer is of greater density, and is the principal seat of the ground colour and of those spots which have an indistinct outline. A similar arrangement occurs in the egg of *Larus glaucus*. In some cases the pigment-granules do not appear to be contained in cells, but merely densely congregated; in other cases, the *Sterna Hirundo*, Linn., for example, the pigment-cells are quite evident. If after removing the calcareous matter by means of an acid, the remaining coloured membranes of the egg of *Turdus mustelinus*, hedge-sparrow, &c., be macerated in alcohol, a blue solution will be obtained, which, when allowed to evaporate on white paper, leaves a permanent blue stain.

My friend Mr. Peter Grant has contributed the following notes respecting the action of certain agents upon the membranes (bluish green) of the egg of the foolish guillemot, after the calcareous matter has been removed. They are not changed by cold concentrated nitric acid, but are bleached by chlorine; strong fuming nitrous acid changes the colour to orange-brown; the addition of water changes that colour to grayish yellow. Iodine colours the membrane a deep orange-brown; on adding potash this colour is destroyed; the potash being removed by washing and iodine added, the same colour is produced as before; potash again decolorises it, and so on repeatedly. The membranes by long digestion in concentrated solution of potash gave a yellow solution, which with acetic acid in excess gave copious white flocks. The supernatant liquor afforded distinct indications of the presence of copper. The white flocks when washed and treated with iodine became gray, but were decolorised by potash. Concentrated nitrous acid was coloured yellowish by standing over them; the addition of water gave grayish flocks; the supernatant liquor with carbonate of ammonia yielded more flocks of a gray-yellow, which dissolved in dilute sulphuric acid; the ammoniacal liquid gave slight traces of copper.

The shell first deprived of epithelium and then boiled during two hours in concentrated solution of potass gave a dark yellow solution leaving a purple-olive sediment. This solution afforded evident indications of the presence of copper and manganese.

The olive sediment after being washed was found to be insoluble in muriatic or even strong nitro-muriatic acid. Boiled in nitric acid it gave a deep yellow solution, leaving a slight residue

of colourless silica. The yellow solution afforded distinct evidence of the presence of manganese and iron.

The deeply-seated black and brown spots of the pale variety of the guillemot's egg were found to contain manganese, iron, and silica.

When muriatic acid is employed to remove the epithelium and dissolve the calcareous part of the egg of the lapwing, the natural colour is changed to green. If the shell, not deprived of epithelium nor the membrane of the albumen, be boiled two or three hours in concentrated solution of potass, it yields a dark yellow solution; the deeply-seated dark spots are now changed to red-brown. The yellow solution supersaturated by acetic acid yielded a brown flocculent precipitate; the supernatant fluid, still yellow, afforded traces of the presence of copper. If the shell, after being treated with potass, be now dissolved in very dilute muriatic acid, there only remain a few cobweb-like flocks. The solution contains lime, phosphate of magnesia, and phosphate of lime.

The pale variety of the guillemot's egg affords no trace of magnesia, but contains carbonate and phosphate of lime.

EXPLANATION OF PLATE VII.

Fig. 1. Epithelium and basement membrane of ostrich's egg.
— 2. The same from the egg of the emeu.
— 3. Superficial layer of the egg of the foolish guillemot; it may be most properly described as a cellulo-granular membrane having a tendency to become cracked into polygonal pieces. A few pigment-cells? are seen at one corner.
— 4. Epithelium from the egg of the missel thrush.
— 5. Epithelium and basement membrane of an imperfectly calcified egg from the dilated oviduct of a land rail.
— 6. Epithelium from the egg of *Carbo Floridanus*, Audub.
— 7. Epithelium from the egg of *Ardea Herodias*, Linn.
— 8. Epithelium from the egg of the redstart.
— 9. Deep-seated pigment-cells from the egg of *Sterna Hirundo*, Linn.
— 10. Epithelium from the egg of the greenfinch.
— 11. A layer subjacent to the true epithelium; it is the seat of the colour. From the egg of *Turdus mustelinus*, Gmelin.

XIX.—*On the Insects of Jamaica.* By Philip Henry Gosse.

[Continued from p. 114.]

21. *Heliconia Charitonia.* Of the extensive family *Heliconiadæ*, almost peculiar to tropical America, this is the only species that I ever met with in Jamaica; a circumstance which is the more remarkable, as several others have long been known as common to that island and the other Antilles. This however is perhaps the most abundant Lepidopterous insect we have; I do